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(71) Applicant(s)
Motorola Limited

(Incorporated in the United Kingdom)

Jays Close, Viabes Ind Est, BASINGSTOKE,
Hampshire, RG22 4PD, United Kingdom

(72) Inventor(s)
Vernon Julian Fernandes
Ian Murray Bartlett

(74) Agent and/or Address for Service
Harold Ibbotson
Motorola Limited, European Intellectual Property
Operation, Jays Close, Viabes Industrial Estate,
BASINGSTOKE, Hampshire, RG22 4PD,
United Kingdom

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GB 2253119 A GB 2245455 A GB 2162404 A
EP 0268375 A2 EP 0188322 A2

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(54) Personal base station

(57) A personal base station (10) is provided for a cellular communications system to directly link to a public network (14). The personal base station (10) is connected to a public network (14) and communicates to a mobile station (12) over a digital communications system. The personal base station (10) includes a base station unit having a first interface for communication to the public network (13) and a digital cellular radio interface (11) for communication in a cellular system. The public network may be an integrated services digital network or a public services telephone network.

In a preferred embodiment the personal base station is portable.

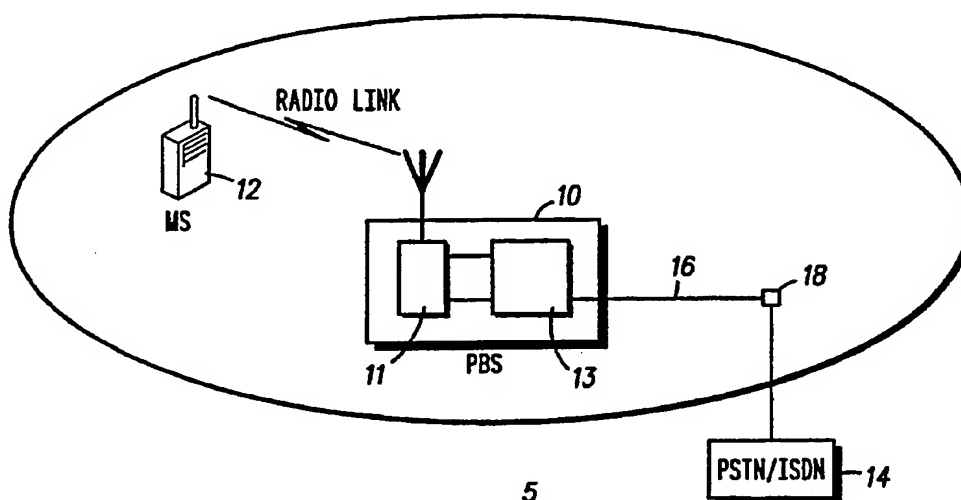


FIG. 1 ⁵

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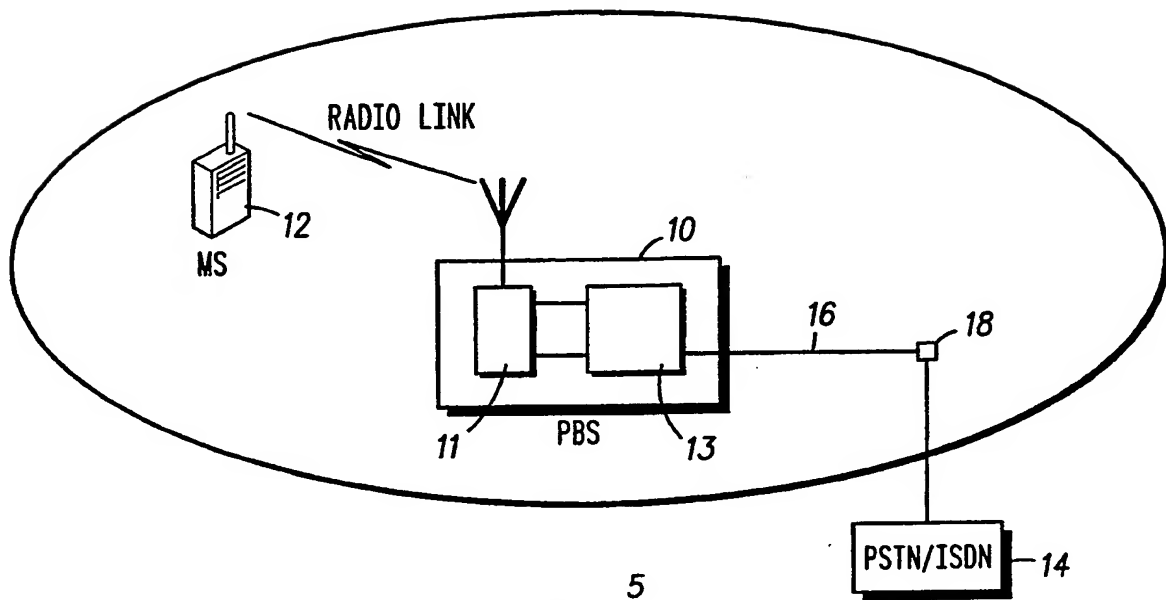


FIG. 1 ⁵

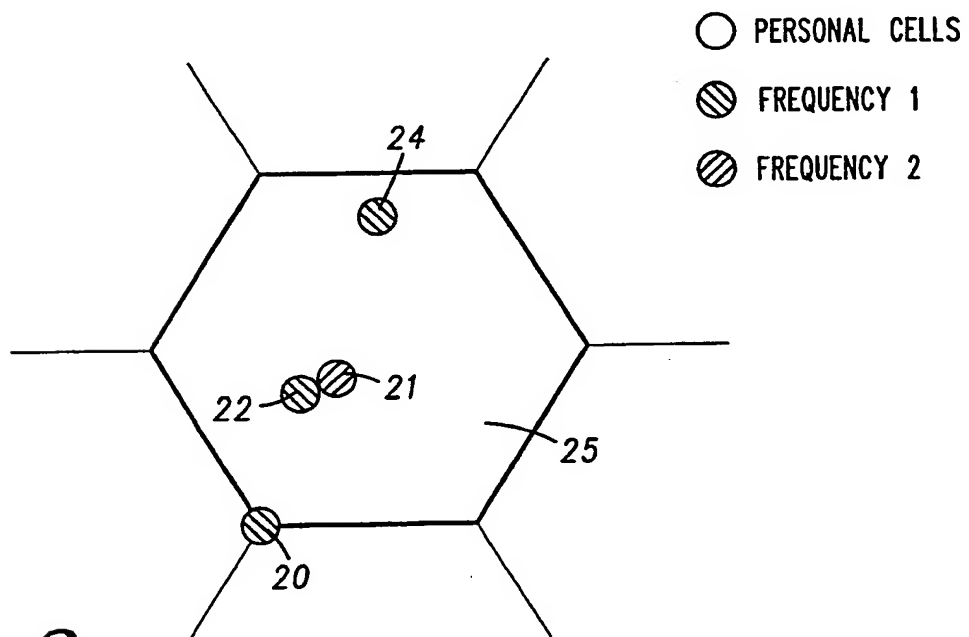


FIG. 2

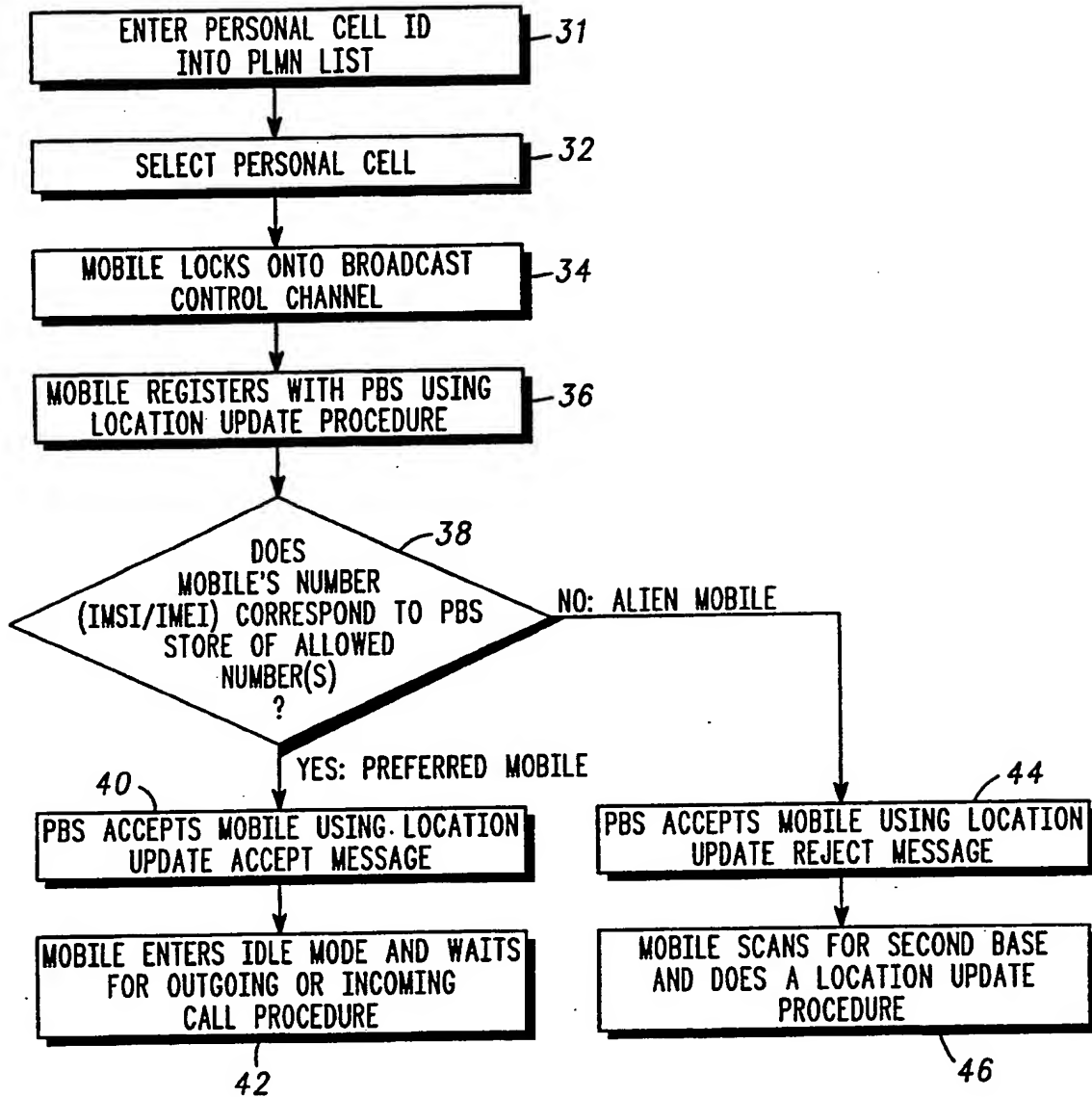


FIG. 3

PERSONAL BASE STATION

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Field of the Invention

This invention relates in general to a communications system,
10 and more particularly to personal base station for use in a
communications system.

Background to the Invention

There are two types of mobile communications systems that
15 exist today for the mass market. Digital cellular communications
systems, such as the GSM (Global System for Mobile
Communications), are highly flexible digital communications systems
that provide roaming and extensive supplementary services for the
user. As a successor to analogue cellular systems such as TACS and
20 NMT, GSM is the dominant digital mobile telephone system in
Europe. However, calling charges are significantly higher than
standard wireline public networks, such as PSTN (Public Services
Telephone Network) or ISDN (Integrated Services Digital Network).
Presently, owners of a cellular telephone need to have a separate
25 standard phone at home in order to access the less expensive
wireline public networks.

Another type of mobile communications system is cordless
telephones, such as CT2. CT2 systems include base stations that
mobile stations communicate to via a radio frequency to access a
30 PSTN network. A disadvantage of such technology is that the mobile
station is restricted for use in a relatively small area, close to its
respective base station. Generally, roaming is only allowed from one
base station environment to a second base station environment in an
idle state as there is no handover capability. CT2 phones also are
35 unable to accept incoming calls outside their respective "home" base
station environment. CT2 phones are only suitable for low power
and low speed applications. CT2 phones are not suitable for a fast
moving mobile environment or for large coverage areas.

There is a need to be able to use a same mobile station to access both a cellular environment when "roaming" and a wireline public network when "home". Additionally, it would be desirable to provide a scheme that allows access to both a digital cellular environment and a wireline public network without the need for changing mobile stations. There is a need to have a home or personal base station that can fully exploit a wireline network for a cellular phone.

10 Summary of the Invention

According to the present invention a personal base station is provided. The personal base station is connected to a wireline public network and communicates to a mobile station over a digital communications system. The personal base station includes a base station unit having a first interface for communication to the wireline public network and a digital cellular radio interface for communication in a cellular system. The wireline public network may be an integrated services digital network or a public services telephone network.

20 In a preferred embodiment the personal base station is portable.

Brief Description of the Drawing

FIG. 1 is a system view of network communications system including a personal base station according to the present invention.

FIG. 2 illustrates a number of personal cells within a macro cell of a cellular communications system.

FIG. 3 is a flow chart for a method for requesting service from a personal base station according to a preferred embodiment of the present invention.

Detailed Description of the Preferred Embodiment

Referring to FIG. 1, a system view of a communications system including a personal base station network 5 according to the present invention is shown. A mobile station 12 communicates to a personal base station 10 (or base station unit) over a radio frequency using a

digital cellular radio interface such as those provided in standard cellular base stations. The personal base station 10 establishes a radio link with mobile station 12 using standard digital communications messages such as those established in a digital cellular system such as GSM. The personal base station 10 includes a terrestrial link 16 such as wireline but may be any type of communications link, including optical, that provides access to a public network 14. The access to a public network is shown including a wireline link 16 via a phone point 18 to a public network 14, such as a public services telephone network (PSTN) or an integrated services digital network (ISDN) using standard wireline procedures. Although the digital communications system is described as being a GSM communications system, the communications system may be any cellular communications system that a mobile station uses to communicate to a base station.

The personal base station 10 includes intelligence to handle messages of the cellular network including those typically passed from a typical base station to a mobile switching centre or regional controller. The personal base station 10 includes a transceiver 11 and a controller 13 to handle the messages that are usually handled in a digital cellular network by infrastructure. For example, in order to set up a call, originated by a mobile station 12, the personal base station 10 allocates a communications resource for the personal base station 10 and the mobile station 12 to communicate over. The personal base station 10 identifies the type of service required, authenticates service, transmits the number of a called mobile station, alerts and connects subscribers end to end. A typical digital cellular base station only allocates a communications resource while authentication and service allocation is a network function handled at further control centres. In the preferred embodiment of the present invention, the personal base station 10 would handle all stages of the call. Even network controlled functions are controlled by the personal base station 10. The personal base station 10 will have all of the characteristics of a preferred mobile station pre-programmed in its system in order to fully function as an independent digital cellular personal base station 10 communicating

directly to a non-cellular public network system 14. The personal base station 10 and the mobile station 12 are a pre-programmed pair and phone characteristics, such as International Mobile Subscriber Identity (IMSI) are pre-programmed in the personal base station 10.

In a standard digital cellular network all base stations exchange control information with the Public Land Mobile Network (PLMN). In this way, the operating frequencies of a base station and identities of neighbouring cells are provided to the base station. Thus, a frequency plan may be implemented. In the present invention, a personal base station 10 has no link to the PLMN and as such the personal base station 10 must identify its own operating frequency by scanning the digital cellular band and selecting any available frequency. Since a cell size of a personal base station 10 is much smaller than a typical cell in a digital cellular system there is no impact on the frequency plan of the cellular system. For example, a personal base station 10 may have only have a cell size of 10 metres whereas a cell in a digital cellular system may be 1 to 35 kilometres.

FIG. 2 shows a number of personal cells 20, 21, 22, 24 within a macrocell 25 in a cellular communications system. Each personal cell 20, 21, 22, 24 is defined by a respective personal base station (not shown in FIG. 2). A different frequency is used for the personal cells 20, 21, 22, 24 than for the macrocell 25. There is a high number of frequencies reused among the personal cells 20, 21, 22, 24 because the personal cells 20, 21, 22, 24 are much smaller than the macrocell 25 and may be spaced so that they do not cause interference among themselves. Thus, a number of personal cells 20, 22, 24 may reuse the same frequencies. If personal cells are located close together 21, 22 then they use different frequencies.

All base stations continuously transmit a broadcast control channel so that mobile stations may register (or lock) on a base station. On the broadcast control channel, the base station transmits system information messages that inform the mobile station about the configuration and status of the network. The personal base station 10 can use this facility to transmit an identity of its

preferred mobile station. Since all mobile stations decode the broadcast control channel information, the presence of a personal cell will be detected when the mobile station recognises its identity in the broadcast message. The mobile station will then lock on the personal base station 10 giving it preference to other interfering cells. This mechanism is similar to selecting microcells in preference to macrocells in a microcellular system. If an alien mobile station inadvertently locks on the personal base station 10 it may be rejected by the personal base station, for example, by a location update reject procedure which is explained in the GSM specifications.

FIG. 3 is a flow chart showing a method for a mobile station 12 requesting service from a personal base station 10 according to a preferred embodiment of the present invention. A personal cell identification must be entered in a PLMN list for the mobile station 12 at least once prior to attempting to register with the personal base station as in step 31. For example, in the GSM specifications, a PLMN selection procedure may be invoked in either an automatic or manual mode. In the present invention, the personal cell identification is selected as the PLMN in step 32.

The mobile station 12 locks on to the personal base station's broadcast control channel at step 34 using a radio received signal. If the mobile station is in the cell of the personal base station 10, the mobile station registers with the personal base station 10 using a location update procedure as described in the GSM specifications in step 36. If the mobile station's identification number corresponds to a number on an allowed list of numbers for the personal base station in step 38 then the mobile station is a preferred mobile station 12 and the personal base station 10 accepts the mobile station 12 using a location update accept message at step 40.

The mobile station 12 then enters an idle mode and waits for an outgoing or incoming call procedure. If the mobile station's identification number does not correspond to a number on the allowed list of numbers for the personal base station 10 then the mobile station is an alien mobile station and the personal base station 10 rejects the mobile station using a location update reject

message in step 44. The mobile station may then scan the system for another base station at step 46.

Once a called number has been received by the personal base station 10 a link is established by an auto dialling action of the
5 personal base station 10 into a wireline network. When the called number is answered, end to end connectivity on a speech channel can be established. A standard digital communication of 13 kbps transcoded speech used by the mobile station is converted to a 64 kbps pulse code modulation (PCM) or analogue signals by the
10 personal base station 10 in order to be communicated over the wireline public network.

Receiving calls (mobile terminated) involves a similar process. The personal base station 10 pages the mobile station (if available) as soon as a call arrival "ringing" state of a public network is
15 recognised. When the mobile station answers the personal base station 10 goes "off hook" and a speech path is established.

Thus, the personal base station of the present invention provides capability with a cellular communications system and can route mobile calls over a standard wireline network by using a
20 domestic subscriber's phone point. The benefits of a standard wireline network are provided for a cellular phone subscriber in a personal cell facility. The cellular phone subscriber does not need to have two phones, one for a cellular system and one for a direct link to a wireline public network. The cellular phone subscriber may
25 simply use his cellular phone in both environments. The benefits of low cost and mobility are provided by the present invention. The present invention significantly expands the use and economics of a cellular phone since the features of both the cellular communications system and a wireline public network may be exploited with the
30 same phone unit.

The present invention provides a product and a method to enable low cost calls to be made by a digital cellular phone via a personal base station 10 placed in a subscriber's home. Unlike cordless phone systems full compatibility with a digital cellular
35 system with all its features is provided. Additionally the personal

base station 10 may be moved from phone point to phone point producing a mobile personal cell facility.

Claims

1. A personal base station having a connection to a wireline public network for communication to a mobile station over a digital communications system, the personal base station comprising:
 - a base station unit having a first interface for communication to the wireline public network and a digital cellular radio interface for communication in a cellular system.
2. The personal base station of claim 1 wherein the base station unit is portable.
3. The personal base station of claim 1 or 2 wherein the first interface for communication to the wireline public network includes a terrestrial link.
4. The personal base station of any preceding claim wherein the wireline public network is an integrated services digital network.
5. The personal base station of any preceding claim wherein the wireline public network is a public services telephone network.
6. A method for accessing a wireline public network via a personal base station, in which the personal base station communicates with at least one mobile station via a digital cellular communications system, said method comprising the steps of:
 - entering a mobile station's identification into an allowed users list in the personal base station;
 - requesting communication by the mobile station with the personal base station thereby requesting access to the wireline public network; and
 - accepting mobile station as a registered user if the mobile station's id is on the allowed users list.
7. The method of claim 6 further comprising the step of:

selecting from a set of at least a personal base station and at least one cellular public network base station the personal base station in preference to at least one cellular public network base station.

8. The method of claim 7 wherein the step of selecting the personal base station comprises the steps of:

entering a personal cell identification into a cellular public network list in the mobile station;
scanning the cellular public network list; and
selecting the personal cell from the list.

9. The method of claims 6, 7 or 8 further comprising the steps of:

scanning a cellular band to identify an available set of radio frequency channels for the mobile station to communicate to the personal base station over; and

selecting one radio frequency channel for the mobile station to communicate to the personal base station.

10. A personal base station having a connection to a wireline public network for communication to a mobile station over a digital communications system substantially as herein described with reference to FIG. 1 of the drawing.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (I. Search report)		Application number GB-9326313-5
Relevant Technical Fields (i) UK Cl (Ed.M) H4K (KY4, KY4D, KY4D2, KY4D10, KY4P and KY45) H4L (LDSX) (ii) Int Cl (Ed.5) H04Q (7/04)		Search Examiner KEN LONG
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE DATABASE: WPI		Date of completion of Search 14 APRIL 1994 Documents considered relevant following a search in respect of Claims :- 1-5 and 10

Categories of documents

X:	Document indicating lack of novelty or of inventive step.	P:	Document published on or after the declared priority date but before the filing date of the present application.
Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	E:	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	&:	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2253119 A	(MERCURY) see particularly page 2 lines 16 to 25 and page 10 line 20 to page 11 line 19	1,3 and 5
X	GB 2245455 A	(STC) see particularly page 2 lines 1 to 4, page 4 lines 7 to 15, page 5 lines 21 to 27 and page 13 line 17 to page 14 line 5	1,3 and 5
X	GB 2162404 A	(RACAL) see particularly page 1 lines 5 to 9, page 2 lines 11 to 17 and 97 to 100, page 3 lines 33 to 56 and page 5 lines 8 to 16 and 79 to 85	1,3 and 5
X	EP 0268375 A2	(NORTHERN TELECOM) see particularly column 2 lines 38 to 54, column 3 lines 32 to 34, column 6 lines 1 and 36 to 40, column 7 lines 3 to 21 and column 8 lines 18 to 32	1 to 3 and 5
X	EP 0158322 A2	(SINCLAIR) see particularly page 2 lines 6 to 17 and page 3 lines 3 to 17	1 to 3 and 5

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